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# INCOMES FROM FARMING AND COST OF APPLE PRODUCTION IN THE SHENANDOAH VALLEY, FREDERICK COUNTY, VA.[1]

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## INTRODUCTION

The Apple Pie Ridge orchard section of the Shenandoah Valley in Virginia is a part of the Shenandoah-Cumberland Valley apple belt, a commercial apple-producing section that is increasing in importance with respect to the quantity of apples supplied to the market. Unlike many of the new commercial apple sections, which previous to the growing of apples have had little agricultural significance, the Shenandoah Valley has long been noted for its agricultural contributions.

Production of apples on a commercial scale in the valley represents a shifting in type of agriculture caused largely by economic forces. Comparative costs and returns have been such that on many farms there has been a change from a system of general farming in which wheat played an important part to a system in which the production of apples is of first importance. This change in the type of agriculture has been more or less gradual, and although orcharding is carried on extensively in the valley to-day, there are many farmers who still follow the old systems of general farming.

Realizing that the area around Winchester, Va., is the center of a large regional development of commercial orchards, and that such transition in types of farming would present many problems in organization, the Bureau of Agricultural Economics began an economic survey in this region in 1916 which continued through the year 1921.

Orchards included in this study are located in Frederick County, Va., near Winchester, and many of them on Apple Pie Ridge. They are a part of a very extensive commercial area which extends through

[1] This work was made possible through the help extended by various members of the staff of the Bureau of Agricultural Economics. Harvey W. Hawthorne and Henry A. Miller gave much aid in gathering the data and made valuable suggestions in the course of outlining the content of the bulletin.

the Shenandoah and Cumberland Valley of Virginia, West Virginia, Maryland, and Pennsylvania. (Fig. 1.) Mountains on each side of the valley give considerable protection from storms and sudden changes of weather. The soil is of limestone origin and has excellent drainage.

The field work covered 125 farms for a period of five years (1916–1920), and 48 of these farms, classed as orchard farms, were carried a sixth year, 1921, to obtain facts relative to the severe freeze of that year. Inasmuch as a freeze is not a normal expectation every six years the 1921 figures do not appear in all averages. Average figures are sometimes shown which include results for the year 1921, for purposes of illustration and comparison.

Wide variation in the degree of diversification was found on the 125 farms. Some farms had little or no area in orchard; on others the area in orchard equaled the area in other crops; and other farms

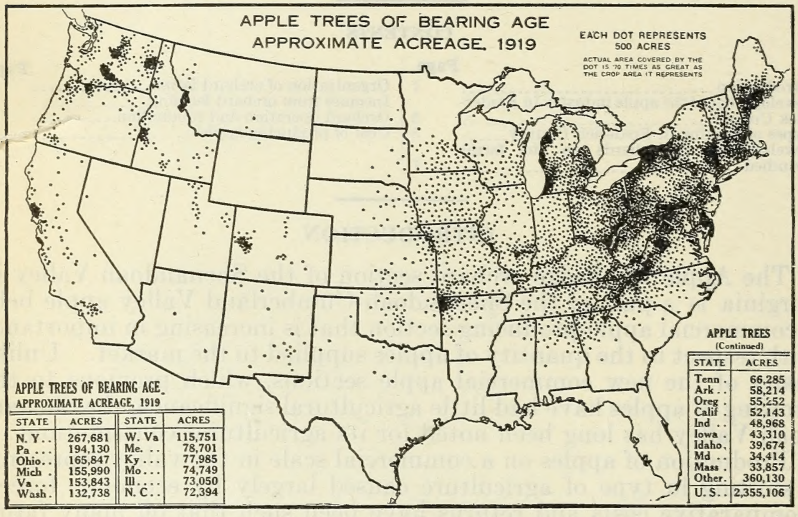


FIG. 1.—The northwestern part of the State of Virginia in which this study was made is one of the most intensive apple-producing areas in the United States

were almost entirely dependent on the orchard enterprise for their income. Since orcharding is gradually superseding other types of farming here, there are farms in every stage of the transition period from general diversified farming to straight orchard farming.

To study the organization of farms in different stages of orchard development, they have been sorted into types, according to the percentage of the total farm receipts received from the sale of apples as shown by five-year averages. If 75 per cent or more of the total receipts on any farm was from apples, the farm was classed as an orchard farm; if 25 to 75 per cent of the total receipts on any farm was from apples, it was classed as a mixed farm; if less than 25 per cent of the total receipts on any farm was from apples, it was classed as a general farm.

Since the net returns from the orchard type of farming during the time of this study were so much greater than the returns from either of the other types, an analysis of the organization of the "mixed"

and "general" farm types as well as the orchard farms has been made. But this bulletin is devoted principally to presenting a picture of the farm organization and the costs of production as found on the orchard type of farm, of which there were 48. The data have been analyzed with a view to determining the most effective organization from the standpoint of lowering costs and increasing the net return for the orchard farm.

The change from other types of farming to orcharding is often materially influenced by the length of time necessary to develop bearing orchards, by the early experience and training of the farmers themselves, by their financial ability, or by general cycles in production and price of apples. Therefore problems of organization are more clearly outlined if the history of the development of the orchard industry in this region is reviewed briefly before analysis is attempted.

## DEVELOPMENT OF THE APPLE INDUSTRY IN FREDERICK COUNTY

Most of the first settlers in this locality came in the eighteenth century, chiefly from New York, Pennsylvania, and eastern Virginia, and it is the descendants of these early settlers who form the largest number of the growers to-day. The first settlers brought to this section the type of agriculture to which they had become accustomed, and indications of that type have persisted through the many generations. From an economic standpoint this factor has significance, for customs of long standing often modify the rate of progress in new developments (fig. 2).

The early type of farming in this section of the valley was such that each farm was largely self-sufficient, with a surplus of wheat which could be exchanged for those necessities not produced in the community. When this region was settled, and for a century afterwards, there were no great wheat regions in the United States and Canada. The early settlers here found the soil and climate particularly adapted to wheat growing, and with the development of the country wheat became the outstanding cash crop of this valley.

With the opening of vast areas of relatively cheap land west of the Mississippi River, peculiarly fitted to wheat production, these Virginia farmers were brought gradually into keen competition with outside wheat growers. Confronted with this condition and realizing that there was an increasing city population near home, the farmers of Frederick County gradually built up their present apple industry. It is said that the first grower who made orcharding his main enterprise was subjected to much ridicule. In time the wisdom of the undertaking was apparent to many other enterprising farmers of Frederick County and the number of plantings increased rapidly.

Up to the present time Frederick County has shown a greater increase in number of trees planted than any other county in Virginia. In Table 1 are the number of bearing trees in the State of Virginia and in Frederick County. Although there were about the same number of trees of bearing age in the entire State in 1924 as in 1899, during the same period the number of bearing trees in Frederick County had increased from 192,888 to 645,584, an increase of about 235 per cent. Frederick County in 1924 had approximately 8 per cent of the total number of bearing trees and about 10 per cent of the apple production of the State.

TABLE 1.—*Growth of the apple industry in Virginia and Frederick County, Va., 1889–1924* [1]

| Year | Virginia | | Frederick County | |
|---|---|---|---|---|
| | Bearing trees | Production | Bearing trees | Production |
| | *Number* | *Bushels* | *Number* | *Bushels* |
| 1889 | 4,253,364 | 8,391,425 | 87,323 | 158,426 |
| 1899 | 8,190,025 | 9,835,982 | 192,888 | 305,161 |
| 1909 | 7,004,548 | 6,103,941 | 273,245 | 351,490 |
| 1919 | 7,385,277 | 8,942,520 | 566,602 | 1,069,546 |
| 1924 [2] | 8,060,674 | 13,242,049 | 645,584 | 1,279,790 |

[1] Bureau of the Census. [2] Subject to revision.

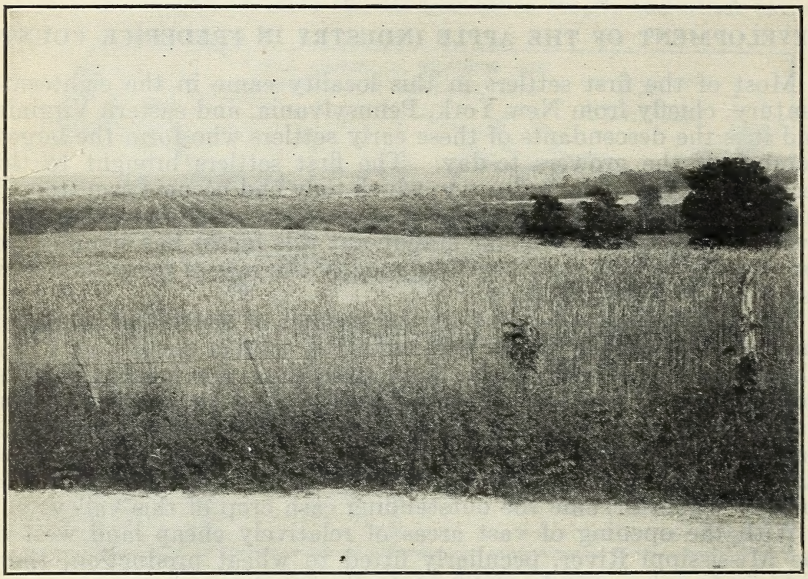

FIG. 2.—View across the Shenandoah Valley near the Kernstown battle field. Beyond the wheat in the foreground is a 100-acre apple orchard, one of the best of 48 orchards studied

TABLE 2.—*Acreage and production of the principal crops grown in Frederick County, Va., 1879–1924* [1]

| Year | Wheat | | Corn | | Hay | | Apples | |
|---|---|---|---|---|---|---|---|---|
| | Acreage | Production | Acreage | Production | Acreage | Production | Bearing trees | Production |
| | *Acres* | *Bushels* | *Acres* | *Bushels* | *Acres* | *Bushels* | *Number* | *Bushels* |
| 1879 | 22,058 | 260,412 | 17,711 | 444,295 | 9,406 | 9,499 | ([2]) | ([2]) |
| 1889 | 24,002 | 320,761 | 18,370 | 461,435 | 15,400 | 18,805 | 87,323 | 158,426 |
| 1899 | 31,907 | 315,140 | 24,345 | 485,630 | 15,519 | 15,988 | 192,888 | 305,160 |
| 1909 | 23,276 | 316,017 | 24,147 | 532,370 | 17,103 | 17,169 | 273,245 | 351,490 |
| 1919 | 25,125 | 309,711 | 21,124 | 672,028 | 15,393 | 15,748 | 566,602 | 1,069,546 |
| 1924 [3] | 15,982 | 148,883 | 14,743 | 207,796 | 18,483 | 18,757 | 645,584 | 1,279,790 |

[1] Bureau of the Census. [2] Not available for 1879. [3] Subject to revision.

According to the United States census, the wheat acreage of Frederick County increased from 1879 to 1899 and then began to decline. In 1924 there were only 15,982 acres of wheat compared to 31,907 acres in 1899. Much of this decrease took place during the period 1919 to 1924, for the acreage declined from 25,125 in 1919 to 15,982 in 1924 (Table 2). The corn acreage declined from 24,345 acres in 1899 to 21,124 acres in 1919 and then to 14,743 acres in 1924. From 1889 to 1924 the hay acreage varied somewhat, the highest acreage being reported in 1924. The number of bearing apple trees, on the other hand, has shown a decided increase. Besides the wheat and corn land given over to apple trees much land is now planted to orchard that has been considered too rough for general farming. Figures on the acreage of orchard in Frederick County for the census years are not available but based on an estimate of 40 trees to the acre, the following acreage in bearing apple orchards for the different census dates is estimated: In 1889, 2,183 acres; in 1899, 4,822 acres; in 1909, 6,831 acres; in 1919, 14,165 acres; and in 1924, 16,140 acres.

Figures for the census years 1880 to 1920 indicate that while there have been changes in the numbers of the various classes of livestock in Frederick County from one census date to another, these changes have not been of unusual significance. All livestock figures for the 1925 census of Frederick County are not available, but up to 1920 chickens raised had increased from 96,459 in 1890 to 147,667 in 1910 and then decreased to 123,155 in 1920. The 1880 census shows 10,869 hogs on farms in Frederick County, the 1900 census shows 16,636, the 1920 census shows 14,638, and a preliminary estimate for 1925 shows 9,143 head of hogs. Sheep have declined from the high point of 13,898 head in 1880 to 7,193 head in 1920. All cattle varied somewhat from year to year, with a total of 9,824 head in 1880 and a total (preliminary) of 9,233 in 1925. The production of eggs increased from 167,740 dozens in 1880 to 567,344 dozens in 1920. The production of milk has varied somewhat for census years but has usually been somewhat above 1,250,000 gallons.

## TYPES OF FARMING IN FREDERICK COUNTY

As apple orcharding is the outstanding new enterprise in Frederick County, it is interesting to note the principal characteristics that differentiate the operation of the orchard farm from the older general type of farms. The five-year average (1916–1920) business summaries for the three classes of farms, as previously defined, are given in Table 3.

The general farms, on which less than 25 per cent of the receipts was from apples, averaged 168 acres in size and were valued at an average of $22,145. This class of farms paid the operators an average of $235 for their labor after 5 per cent was taken from the net returns as interest on the total sales value of the farm.

The mixed farms, or those farms on which 25 to 75 per cent of the total receipts was from apples, averaged 176 acres in size and were valued at an average of $27,835. These farms, over the five years, returned an average of $618 annually to the operators in addition to 5 per cent on the average farm value.

The orchard farms, or those farms having 75 per cent or more of their total farm receipts from apples, were 137 acres in size and were

valued at an average of $35,788. After returning 5 per cent on this valuation they paid an average of $2,443 as an annual income to the operators for their labor and management.

TABLE 3.—*Summary of the farm business of three types of farms in Frederick County, Va., average for 1916–1920*

| Type of farm [1] | Farms studied | Size of farm | Distribution of farm area | | | Farm valuation | Farm receipts | Farm expenses | Farm income [3] | Labor income [4] | Net percentage return on farm valuation [5] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Woods pasture and waste | Bearing orchard | Other crops and young orchard [2] | | | | | | |
| | *No.* | *Acres* | *Acres* | *Acres* | *Acres* | *Dolls.* | *Dolls.* | *Dolls.* | *Dolls.* | *Dolls.* | *Per cent* |
| General | 32 | 168 | 73 | 6 | 89 | 22,145 | 2,843 | 1,501 | 1,342 | 235 | 3.5 |
| Mixed | 45 | 176 | 72 | 24 | 80 | 27,835 | 4,525 | 2,515 | 2,010 | 618 | 4.9 |
| Orchard | 48 | 137 | 38 | 52 | 47 | 35,788 | 10,217 | 5,985 | 4,232 | 2,443 | 9.4 |

[1] General farms: Less than 25 per cent of receipts from fruit.
Mixed farms: From 25 to 75 per cent of receipts from fruit.
Orchard farms: Over 75 per cent of receipts from fruit.

[2] The principal farm crops other than apples are wheat, corn, and hay. Young orchard, included in other crop acreage, was 8 acres for the general farm, 9 acres for the mixed farms, and 20 acres for the orchard farms.

[3] Farm income—the difference between receipts and expenses.

[4] Labor income—the amount the farmer has left for his labor and management after 5 per cent interest on the farm valuation is deducted from the farm income.

[5] Per cent returned on farm valuation is obtained by deducting what the operator considers his time worth from the "farm income" and dividing this balance by "farm valuation."

In addition to the money returns the farms furnished a certain amount of the family's living. For the years 1918, 1919, and 1920 the average value per farm of the family living furnished by each type of farm was: General farms, $624; mixed farms, $611; and fruit farms, $435.

In the general type of farm the crop area was planted principally to corn, wheat, and hay (Table 4). Some corn and hay were sold, but much of it was used as feed. Livestock was the largest and wheat was the second largest source of receipts on these general farms.

The crop acreage on the mixed type of farms was rather equally distributed among four major crops—apples, corn, wheat, and hay. Although the receipts came principally from three sources—apples, livestock, and wheat—over 50 per cent came from apples.

The crop area on the orchard farms was given over largely to orchards, with the remainder of the farm in crops needed for feed. On many orchard farms a small quantity of each farm product common to the valley section was produced and sold. The opportunities for large receipts were greater in the production of apples than in the production of other farm commodities, and the orchard returned much more per acre of land and per dollar of expenditure than did any other enterprise.

Under these circumstances the proper care of the orchards becomes very important. As the orchards increased in size and as they became a more important part of the farm organization the yield of apples per acre was increased. It is believed that the reason lies largely in the greater attention directed toward the orchard in the way of better pruning, spraying, cultivation, and fertilization.

TABLE 4.—*Crop area, yield per acre, crop receipts, and productive animal units and receipts from livestock under different systems of farming; average for 1916–1920*

| Item | Crop acreage | | | Yield per acre [1] | | | Crop receipts | | |
|---|---|---|---|---|---|---|---|---|---|
| | General farms | Mixed farms | Orchard farms | General farms | Mixed farms | Orchard farms | General farms | Mixed farms | Orchard farms |
| Crops: | *Acres* | *Acres* | *Acres* | *Bbls.* | *Bbls.* | *Bbls.* | *Dolls.* | *Dolls.* | *Dolls.* |
| Apples [2] (bearing) | 6 | 24 | 52 | 20 | 44 | 62 | 247 | 2,417 | 9,464 |
| | | | | *Bush.* | *Bush.* | *Bush.* | | | |
| Corn | 22 | 21 | 10 | 36 | 38 | 34 | 230 | 132 | 82 |
| Wheat | 33 | 28 | 9 | 16 | 15 | 15 | 891 | 671 | 227 |
| | | | | *Tons* | *Tons* | *Tons* | | | |
| Hay | 22 | 19 | 8 | 0.9 | 1.0 | 0.9 | 149 | 108 | 24 |
| Other crops | 4 | 3 | 1 | | | | 38 | 39 | 20 |
| | Animal units [3] | | | Receipts per animal unit | | | Receipts per farm | | |
| Livestock (does not include work stock) | *No.* 21.7 | *No.* 20.1 | *No.* 9.0 | *Dolls.* 48 | *Dolls.* 47 | *Dolls.* 37 | *Dolls.* 1,028 | *Dolls.* 945 | *Dolls.* 317 |

[1] Yield of apples per acre includes both packed and cull apples.
[2] Total acreage in apples, including bearing and nonbearing trees, for the different farm types respectively were: General farms, 14; mixed farms, 33; and orchard farms, 72.
[3] Different classes of livestock were reduced to a common unit as follows: One grown cow or horse is equivalent in feed consumption to 2 colts or young cattle, 3 hogs, 7 sheep, 14 lambs, or 100 chickens.

## DEVELOPMENT OF ORCHARDS ON THE FARMS STUDIED

The development of commercial apple orchards on the 48 farms studied in Frederick County has taken place largely since 1898 (Table 5). The farmers made two or more plantings in the interval of about 20 years at such times as they thought expedient and as they were financially able to make them.

The largest number of trees planted on these farms were in the five-year period 1901–1905 (Table 6), when 29 per cent of the plantings on the 48 orchards was made. The largest planting for a single year was 453 acres in 1903. Eighty-two per cent of the bearing acreage on these 48 farms was under 25 years of age and 63 per cent was under 20 years (Table 7). The farms studied showed the greatest orchard development between 1900 and 1910 but for the county as a whole there were larger plantings of trees in the period 1910 to 1920 than during any other 10-year period.

The winter apple industry, for some time prior to 1910, was not only favored by ascending prices but the purchasing power of apples was considerably greater than for most other agricultural products. Since 1910 this prestige has been lost and during most of this time apples have been cheap compared with the price of all commodities. Naturally, plantings are usually made because apples have been profitable. On these 48 farms 68 per cent of the acreage was planted during the period 1896 to 1910 and 17 per cent was planted during 1911 to 1915. From 1916 to 1921 relatively few trees were set out on these farms.

TABLE 5.—*Acreage of orchard planted in different years since 1881 on 48 orchard farms, Frederick County, Va.*

| Farm No. | Acres per farm | Date and acreage planted | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1921 | 1920 | 1919 | 1918 | 1917 | 1916 | 1915 | 1914 | 1913 | 1912 | 1911 | 1910 | 1909 | 1908 | 1907 | 1906 | 1905 | 1904 | 1903 | 1902 | 1901 | 1900 | 1899 | 1898 | 1897 | 1896 | 1895 | 1894 | 1893 | 1892 | 1891 | 1890 | 1889 | 1888 | 1887 | 1886 | 1885 | 1884 | 1883 | 1882 | 1881 | Age unknown |
| 9 | 191 | | | | | | | | | | | | | | | | | | 143 | 48 | | | | | | | | | | | | | | | | | | | | | | | |
| 150 | 200 | | | | | | | | | 29 | | | | | | | | | | | | | | 171 | | | | | | | | | | | | | | | | | | | |
| 6 | 150 | | | | | | | | | 30 | | | | | | | | 60 | | | | | | 60 | | | | | | | | | | | | | | | | | | | |
| 155 | 100 | | | | | | | | | | | | | | | | | 25 | | 75 | | | | | | | | | | | | | | | | | | | | | | | |
| 174 | 135 | | | | | | | 25 | | | 6 | | | | 25 | | | | | | | | | 20 | | | | | | | | | | | | | 55 | | | | | | 4 |
| 15 | 99 | | | | | | | | | | | | | | | | | | | 59 | | | 40 | | | | | | | | | | | | | | | | | | | |
| 177 | 132 | 10 | | | | | 7 | | | | | | | | 50 | | | | | | | 15 | | | | | | | | | 15 | | | 35 | | | | | | | |
| 43 | 111 | | 16 | | | | | | | | | | | | | | | | | | | | | | | | | | 50 | | | | | 45 | | | | | | | |
| 71 | 115 | | | | | | | | | | 12 | | 20 | 12 | | | | | | | | 23 | | | | 28 | | | | | | | | | | | | | | | 20 | |
| 33 | 121 | | | | 19 | | | | | | | 20 | | | 20 | | | | | 43 | | 15 | | | | | | | 4 | | | | | | | | | | | | | |
| 69 | 115 | 12 | | | | | | | | | 14 | 25 | | | | 15 | | | | | 19 | | | | | 10 | | | | | 20 | | | | | | | | | | | |
| 156 | 160 | | | | | | | | | | | | 95 | | 20 | | | | | 45 | | | | | | | | | | | | | | | | | | | | | | |
| 44 | 71 | | | | | | | | | 26 | | | | | | | | | | 10 | 12 | | | | | 13 | | | | | | | | | | 10 | | | | | | |
| 97 | 62 | | | | | | | | | | | | | | | 17 | | | | | | | | | 27 | | | | | | | | | | | | | | | | | |
| 113 | 99 | | | | | | | | | | | 3 | | | | | | 3 | 15 | | | 14 | | 60 | | | | | | | | | | | | 4 | | | | | | |
| 149 | 75 | | | | | | | | | | 20 | | | | | | | | | 26 | | | | 20 | | | | | | | | | | | | 9 | | | | | | |
| 77 | 60 | | | | | | | | | | | | | | | | | 20 | | 20 | | | | 20 | | | | | | | | | | | | | | | | | | |
| 20 | 77 | | | | | | | | | | | 29 | | | | | | | | 48 | | | | | | | | | | | | | | | | | | | | | | |
| 162 | 50 | | | | | | | | | | | | | | 6 | | | | | | | | | | 6 | | | | | | | 9 | | | | | | 9 | | 16 | 4 | |
| 66 | 67 | | | | | | | | | | | | 22 | | | | | | | | 15 | | | | | | | | | | | | | 30 | | | | | | | |
| 160 | 68 | | | | | | | 6 | | | | | | 12 | 50 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 23 | 74 | | | | | | | | | | | 17 | | 25 | | | | | | | | 16 | | 16 | | | | | | | | | | | | | | | | | |
| 28 | 50 | | | | | | | | | | | | | | | | 18 | | | | 25 | | | | | | | | | | | | | | 7 | | | | | | |
| 93 | 47 | | | | | | | | | | | | 17 | | | | | | | | | | 30 | | | | | | | | | | | | | | | | | | |
| 63 | 45 | | | | | | | | | 5 | | | | | 20 | | | | | 20 | | | | | | | | | | | | | | | | | | | | | |
| 115 | 133 | 25 | | | | | | | | | | 37 | | 50 | | | | | | | | | | | | | 21 | | | | | | | | | | | | | | |
| 61 | 115 | 15 | | | | | | | | | 30 | 30 | 25 | | | | | | | 15 | | | | | | | | | | | | | | | | | | | | | |
| 132 | 81 | | | | | 15 | | | 10 | | 16 | | | 10 | | | | | | | | | 15 | 15 | | | | | | | | | | | | | | | | | |
| 98 | 40 | | | | | | | | | | | | | 20 | | | | | | | | 20 | | | | | | | | | | | | | | | | | | | |
| 60 | 40 | | | | | | | | | | | | | 18 | | | | | | | 22 | | | | | | | | | | | | | | | | | | | | |
| 46 | 42 | | | | | | | 5 | | 3 | | | 10 | | | | 5 | | | | | | | | | | | | 9 | | | | | | | 10 | | | | | |
| 158 | 73 | 23 | | | | | | | | 18 | | | | | | | | 8 | 8 | 8 | | | | | | | | | | | | | | 8 | | | | | | |
| 35 | 33 | | | | | | | | | | | | | | | | 8 | 7 | | | | | 15 | | | | | | | | | | | | | | | | | | 3 |
| 55 | 65 | 4 | | | | | 2 | | 8 | | | 30 | | | | | | | 14 | | | 3 | | | | 2 | 2 | | | | | | | | | | | | | | |
| 101 | 134 | | | | | | | | | | 80 | | | | | | | | | | | 24 | 22 | | | | | | | | | | | | | | | | | | 8 |
| 62 | 32 | 2 | 2 | | | | | | | | | | | | 8 | | | 20 | | | | | | | | | | | | | | | | | | | | | | |
| 50 | 24 | | | | | | | | | | | | | | | | | | | 24 | | | | | | | | | | | | | | | | | | | | |
| 163 | 32 | | | | | | | | | | | | 16 | | | | | | | | | | | | | 16 | | | | | | | | | | | | | | |
| 146 | 24 | | | | | | | | | | | | | 12 | | | | | | | 9 | | | | | 3 | | | | | | | | | | | | | | |

| | | |

TABLE 6.—*Apples planted on 48 orchard farms, 1880–1921*

| Year | Acres planted | Cumulative acreage | Percentage of total trees planted during stated periods | Cumulative percentage |
|---|---|---|---|---|
| | *Number* | *Number* | *Per cent* | *Per cent* |
| 1880 and earlier | 18 | 18 | 1 | 1 |
| 1881–1885 | 53 | 71 | 1 | 2 |
| 1886–1890 | 183 | 254 | 5 | 7 |
| 1891–1895 | 161 | 415 | 4 | 11 |
| 1896–1900 | 680 | 1,095 | 19 | 30 |
| 1901–1905 | 1,039 | 2,134 | 29 | 59 |
| 1906–1910 | 726 | 2,860 | 20 | 79 |
| 1911–1915 | 625 | 3,485 | 17 | 96 |
| 1916–1921 | 163 | 3,648 | 4 | 100 |

TABLE 7.—*Distribution of acreage in bearing orchard, by age of trees on 48 orchard farms, 1920*

| Age of trees (years) | Percentage of total trees in bearing | Age of trees (years) | Percentage of total trees in bearing |
|---|---|---|---|
| | *Per cent* | | *Per cent* |
| 10–14 | 27 | 30 and over | 10 |
| 15–19 | 36 | | |
| 20–24 | 19 | All ages | 100 |
| 25–29 | 8 | | |

## VARIETIES OF APPLES

A large proportion of the bearing acreage on the 48 farms was in York Imperial in 1920 (Table 8). This variety occupied 59 per cent of the total acres of bearing trees. The Ben Davis, next in importance, occupied 22 per cent of the total bearing acreage; these two varieties constituted 81 per cent of the total bearing acreage. Yellow Newtown (Albemarle Pippin), Stayman Winesap, Grimes Golden, and Baldwin added 10 per cent more to the bearing acreage, giving 91 per cent of the bearing acreage set in blocks of well-known varieties. Miscellaneous and unknown varieties occurred in small numbers, scattered through a large number of orchards. The miscellaneous group contained the following varieties: Northwestern Greening, Smokehouse, Yellow Transparent, Wealthy, Arkansas (Mammoth Black Twig), King David, and Rome Beauty.

Recent plantings indicated some changes in varieties. The acreage in orchards not of bearing age consisted of 35 per cent York Imperial, 24 per cent Stayman Winesap, 6 per cent Jonathan, 5 per cent Ben Davis, 5 per cent Grimes Golden, 3 per cent Yellow Newtown, 15 per cent miscellaneous, and 7 per cent unknown (Table 8). The miscellaneous varieties included, besides those mentioned in the bearing group, Gravenstein, Delicious, McIntosh, Red Astrachan, Oldenburg (Duchess of Oldenburg), and several summer varieties.

In recent plantings there had been a tendency to get away from the Ben Davis and to put only 35 per cent of the new plantings into York Imperial, whereas 59 per cent of the bearing acreage is in this variety. On the other hand, 24 per cent of the nonbearing apple acreage of these 48 orchards was planted to Stayman Winesap as

against only 2 per cent of the bearing acreage in 1920. As indicated by the large percentage of nonbearing acreage in miscellaneous and unknown varieties, orchardists have been doing considerable experimenting with varieties during recent years.

TABLE 8.—*Distribution of varieties of apples on 48 orchard farms in 1920*

| Varieties | Percentage of total acreage | | Varieties | Percentage of total acreage | |
|---|---|---|---|---|---|
| | Bearing | Non-bearing | | Bearing | Non-bearing |
| | *Per cent* | *Per cent* | | *Per cent* | *Per cent* |
| York Imperial | 59 | 35 | Baldwin | 2 | 0 |
| Ben Davis | 22 | 5 | Jonathan | 1 | 6 |
| Yellow Newtown | 4 | 3 | Miscellaneous | 4 | [1] 15 |
| Stayman Winesap | 2 | 24 | Unknown | 4 | 7 |
| Grimes Golden | 2 | 5 | | | |

[1] Northwestern Greening, Smokehouse, Yellow Transparent, Wealthy, Arkansas (Mammoth Black Twig), King David, Rome Beauty, Gravenstein, Winesap, Delicious, McIntosh, Red Astrachan, Oldenburg (Duchess of Oldenburg), and other early varieties.

## ORGANIZATION OF THE ORCHARD FARMS

### VALUATION OF ORCHARD FARMS

The five-year average sales value of the 48 orchard farms in Frederick County, including real estate, livestock, equipment, supplies, and operating cash, was $35,788, of which the larger portion, $32,364, was in real estate and the balance, $3,424, was in other things, as shown in Table 9. The real-estate valuation was distributed as follows: Land, $28,385; dwelling, $1,847; and other buildings, $2,132. Other capital was divided among these items: Work stock, $533; livestock other than work stock, $627; machinery, $671; feed and supplies, $289; and cash for operating the farm, $1,304.

During the period of this study the total farm valuation increased from $30,505 in 1916 to $46,306 in 1920. In 1921 it had fallen to $43,253, but there were few farm sales during this period. Machinery increased in value per farm from $619 in 1916 to $907 in 1920. Most of this increase was for new machinery bought during this period, particularly tractors and auto trucks. For example, in 1916 an average of $70 per farm was spent for machinery, but thereafter this expenditure gradually increased each year until in 1920 a total of $478 was spent per farm for new machinery. Improvements to buildings were made consistently throughout these years.

The five-year average value of individual farms varied from $9,255 to $160,927. Eight orchard farms were valued at less than $15,000, 7 between $15,000 and $20,000, 3 between $20,000 and $25,000, 5 between $25,000 and $30,000, 7 between $30,000 and $35,000, 4 between $35,000 and $40,000, 4 between $40,000 and $50,000, 5 between $50,000 and $75,000, and 4 over $75,000. The percentage distribution of the average valuation of these 48 orchard farms is given in Table 10.

TABLE 9.—*Average valuation per farm of 48 orchard farms, average for 1916–1920*

| Item | 1916 | 1917 | 1918 | 1919 | 1920 | Average 1916–1920 |
|---|---|---|---|---|---|---|
| Real estate: | *Dolls.* | *Dolls.* | *Dolls.* | *Dolls.* | *Dolls.* | *Dolls.* |
| Land | 23,773 | 23,968 | 23,412 | 33,102 | 37,672 | 28,385 |
| Dwelling | 1,745 | 1,860 | 1,874 | 1,775 | 1,980 | 1,847 |
| Other buildings | 1,815 | 1,785 | 2,048 | 2,236 | 2,774 | 2,132 |
| Total real estate | 27,333 | 27,613 | 27,334 | 37,113 | 42,426 | 32,364 |
| Livestock, equipment, and supplies: | | | | | | |
| Work stock | 601 | 593 | 540 | 490 | 439 | 533 |
| Other livestock | 459 | 559 | 715 | 743 | 660 | 627 |
| Machinery | 619 | 573 | 541 | 714 | 907 | 671 |
| Feed and supplies | 197 | 235 | 462 | 271 | 281 | 289 |
| Operating cash | 1,296 | 1,162 | 1,140 | 1,331 | 1,593 | 1,304 |
| Total livestock, equipment, and supplies | 3,172 | 3,122 | 3,398 | 3,549 | 3,880 | 3,424 |
| Total valuation | 30,505 | 30,735 | 30,732 | 40,662 | 46,306 | 35,788 |

TABLE 10.—*Average distribution per farm of valuation of 48 orchard farms; average for 1916–1920*

| Item | 1916 | 1917 | 1918 | 1919 | 1920 | Average, 1916–1920 |
|---|---|---|---|---|---|---|
| Distribution of valuation: | *Per cent* | *Per cent* | *Per cent* | *Per cent* | *Per cent* | *Per cent* |
| Land | 77.9 | 78.0 | 76.2 | 81.4 | 81.3 | 79.3 |
| Dwelling | 5.7 | 6.0 | 6.1 | 4.4 | 4.3 | 5.2 |
| Other buildings | 6.0 | 5.8 | 6.6 | 5.5 | 6.0 | 5.9 |
| Total | 89.6 | 89.8 | 88.9 | 91.3 | 91.6 | 90.4 |
| Work stock | 2.0 | 1.9 | 1.8 | 1.2 | 1.0 | 1.5 |
| Other livestock | 1.5 | 1.8 | 2.3 | 1.8 | 1.4 | 1.8 |
| Machinery | 2.0 | 1.9 | 1.8 | 1.7 | 2.0 | 1.9 |
| Feed and supplies | .6 | .8 | 1.5 | .7 | .6 | .8 |
| Operating cash | 4.3 | 3.8 | 3.7 | 3.3 | 3.4 | 3.6 |
| Total | 10.4 | 10.2 | 11.1 | 8.7 | 8.4 | 9.6 |
| | *Dollars* | *Dollars* | *Dollars* | *Dollars* | *Dollars* | *Dollars* |
| Total valuation per farm | 30,505 | 30,735 | 30,732 | 40,662 | 46,306 | 35,788 |

### DISTRIBUTION OF THE FARM AREA

The orchard farms surveyed contained an average of 137 acres, of which 99 acres were in crop land and 38 acres in waste, woods, and pasture land. Most of the crop land was in orchard, with an average of 52 acres per farm of bearing trees and 20 acres of nonbearing trees. The remainder of the crop land, 27 acres, was distributed as follows: Corn, 10 acres; wheat, 8 acres; hay, 8 acres; and other crops, usually oats or barley, 1 acre.

The 38 acres not in crop land included 5 acres of waste land, 8 acres of woodland not pastured, 19 acres of permanent pasture, and 6 acres of rotation pasture (Table 11).

The crop acreage, aside from the orchard land, varied all the way from nothing to 137 acres. Of the 48 farms, 8 had no crop land other than that in orchard, 21 had less than 25 acres in crops outside of the orchard, 11 had between 25 and 50 acres, 4 had between 50 and 75 acres, and 4 had more than 75 acres of crops outside of the orchard. Only one of the latter had more than 100 acres.

Additional crop acreage was obtained on a majority of the orchard farms through intercropping of the bearing or young orchards. An average per farm of 22 crop acres was added in this way, making a

total of 44 acres in crops other than apples. A large proportion of the intercropped area of the orchard was planted to corn each year. Hay was the next important interplanted crop. In addition, small acreages of small grains were planted in several of the orchards.

TABLE 11.—*Distribution of acreage per farm on 48 orchard farms; average for 1916–1920*

| Classification of farm acreage | 1916 | 1917 | 1918 | 1919 | 1920 | Average, 1916–1920 |
|---|---|---|---|---|---|---|
| | *Acres* | *Acres* | *Acres* | *Acres* | *Acres* | *Acres* |
| Waste land | 4 | 4 | 5 | 5 | 5 | 5 |
| Woodland not pastured | 8 | 8 | 9 | 8 | 7 | 8 |
| Permanent pasture | 20 | 20 | 18 | 18 | 18 | 19 |
| Rotation pasture | 5 | 5 | 6 | 6 | 6 | 6 |
| Idle crop land | 1 | 1 | | | 1 | (1) |
| Apples, bearing age | 45 | 49 | 51 | 56 | 60 | 52 |
| Apples, nonbearing age | 26 | 23 | 20 | 16 | 13 | 20 |
| Corn | 9 | 12 | 11 | 9 | 8 | 10 |
| Wheat | 9 | 8 | 8 | 9 | 8 | 8 |
| Hay | 8 | 8 | 8 | 7 | 7 | 8 |
| Rye | 1 | | 1 | | | (1) |
| Oats | 2 | 1 | 1 | 1 | | 1 |
| Barley | 1 | | | | 1 | (1) |
| Other crops | 1 | | | | 1 | (1) |
| Total per farm | 140 | 139 | 138 | 135 | 135 | 137 |

[1] No acreage in certain years.

Bearing orchards increased 15 acres per farm during the period of the study. This increase was almost entirely counterbalanced by a decrease of 13 acres in the size of orchard not of bearing age. The average for the 48 farms in 1916 was 45 acres of bearing and 26 acres of nonbearing orchard, whereas in 1920 there were 60 acres of bearing and 13 acres of nonbearing orchard. There was no significant variation in the average acreage of other crops from 1916 to 1920.

The numbers of bearing orchards of various sizes are shown in Table 18. Twelve orchards had less than 25 acres, 18 had between 26 and 50 acres, 7 had between 51 and 75 acres, 7 had between 76 and 100 acres, and 4 had an excess of 100 acres of trees of bearing age. The median orchard had 36 acres of bearing trees.

### LIVESTOCK

A majority of the orchard farms kept some livestock other than work stock, but there were several that kept nothing but work animals. In Table 12 is a summary of the number of farms reporting each class of livestock (not including work animals) and the average number of the various classes kept. Only a few farms kept more than just enough livestock, in addition to the work stock, to supply the needs of the owner and tenant families.

TABLE 12.—*Livestock kept on 48 orchard farms, not including work animals; average for 1916–1920*

| Livestock | Farms reporting each class | Average per farm reporting |
|---|---|---|
| | *Number* | *Number* |
| Horses and colts [1] | 24 | 3 |
| Cows | 34 | 3 |
| Sheep | 4 | 26 |
| Brood sows | 27 | 2 |
| Chickens | 34 | 32 |

[1] Other than work stock.

## LABOR AND MOTIVE POWER

An average of 36.8 months of labor was required to operate these orchard farms up to the time of apple harvest for the five-year period (Table 13). Of this preharvest labor, 23.2 months were hired and 13.6 months were furnished by the operator and his family. Harvesting required an additional 20.5 months of labor, or a little more than half the amount required to run the farm all the rest of the year. Altogether, 57.3 months of labor was required to run these orchard farms which contained an average of 137 acres, 52 acres of which were in bearing orchard.

The operators' labor was valued at an average of $851 per year. The 23.2 months of preharvest hired labor cost about $952, and the 20.5 months of hired harvest labor cost $1,504. There were variations from the five-year averages, during each of these years, in the amounts of labor used per farm, but the greatest variation was found in the amounts of harvesting labor. This is to be expected because of variations in apple yields.

An average of 4.3 head of work stock was kept on these orchard farms in addition to the power furnished by tractors and motor trucks. The number of work stock decreased over the five-year period from 4.6 per farm in 1916 to 3.9 in 1920. Most of the decrease occurred on farms where tractors were purchased during the period. None of the 48 orchard farms had tractors in 1916 or 1917. Two farms had tractors in 1918, 10 had them in 1919, and 15 had them in 1920. The first of the motor trucks was purchased in 1918 and six farmers acquired them that year. Two farmers purchased trucks in 1919 and four farmers purchased them in 1920. Motor trucks also contributed to the decrease in the number of horses kept per farm. Twelve farms had motor trucks by 1920. These orchard farms averaged one spraying outfit of 200-gallon capacity for each 50 acres of orchard.

TABLE 13.—*Labor and power used per farm in the operation of 48 orchard farms; average for 1916–1920*

| Classes of labor and power | 1916 | 1917 | 1918 | 1919 | 1920 | Average 1916–1920 |
|---|---|---|---|---|---|---|
| Labor: | *Months* | *Months* | *Months* | *Months* | *Months* | *Months* |
| Picking and packing (hired) | 24.8 | 12.4 | 23.4 | 17.4 | 24.7 | 20.5 |
| Other hired labor | 24.1 | 24.2 | 24.0 | 21.4 | 22.5 | 23.2 |
| Operator and family | 14.1 | 14.4 | 13.4 | 13.0 | 13.3 | 13.6 |
| Total months | 63.0 | 51.0 | 60.8 | 51.8 | 60.5 | 57.3 |
| Power: | *Number* | *Number* | *Number* | *Number* | *Number* | *Number* |
| Work stock | 4.6 | 4.5 | 4.5 | 4.1 | 3.9 | 4.3 |
| Farms having tractors | | | 2 | 10 | 15 | [1] 5.4 |
| Farms having auto trucks | | | 6 | 8 | 12 | [1] 5.2 |

[1] None of the farms had tractors or motor trucks in 1916 or 1917.

### SOURCES OF RECEIPTS

The principal products sold from the orchard farms were apples, wheat, corn, hay, livestock, and livestock products. Table 14 shows the average quantities per farm of the various crops sold and the prices received. The quantities of each crop sold per farm on the average for the five-year period were as follows: Packed apples, 2,315 barrels; cull apples, 934 barrels; wheat, 110 bushels; corn, 67 bushels; and hay, 1.3 tons. The average quantity of apples sold varied from 1,960 barrels per farm in 1917 to 4,439 barrels per farm in 1920. The quantity of wheat and corn marketed annually per farm decreased over the period of the survey. The average quantity of hay sold per farm changed little except for the last year, 1920, when three times the usual quantity was sold, but, even so, the quantity was only 2.6 tons.

The five-year average prices received by these farmers were as follows: Apples (barreled), $3.60 per barrel; cull apples, $1.20 per barrel; wheat, $2.06 per bushel; corn, $1.22 per bushel; and hay, $18.46 per ton. Apples, wheat, and hay increased in price up to and including 1919, and each in 1920 showed a decrease to almost 1917 levels. Corn increased in price to and including 1918 and after that decreased in price until, in 1920, it was selling at a lower level than in 1916.

Cull apples made up a higher percentage of the total apples produced in years of low production than in the years of more favorable production. The prices received for cull apples were best in the years of low total production.

TABLE 14.—*Quantities of crops sold per farm and average prices received; average for 1916–1920*

| Quantities and prices | 1916 | 1917 | 1918 | 1919 | 1920 | Average 1916–1920 |
|---|---|---|---|---|---|---|
| Quantities: | | | | | | |
| Apples, barreled, bbls. | 3,352 | 1,320 | 2,436 | 1,409 | 3,057 | 2,315 |
| Apples, loose culls, do. | 910 | 640 | 797 | 941 | 1,382 | 934 |
| Corn, bu. | 107 | 121 | 53 | 32 | 21 | 67 |
| Wheat, do. | 143 | 102 | 118 | 105 | 84 | 110 |
| Hay, tons | 1.3 | .8 | .7 | .9 | 2.6 | 1.3 |
| Prices: | *Dollars* | *Dollars* | *Dollars* | *Dollars* | *Dollars* | *Dollars* |
| Apples, barreled, per bbl. | 2.58 | 3.31 | 4.26 | 5.10 | 3.75 | 3.80 |
| Apples, loose culls, do. | .63 | 1.55 | .93 | 2.24 | .63 | 1.20 |
| Corn, per bu. | .99 | 1.35 | 1.47 | 1.41 | .90 | 1.22 |
| Wheat, do. | 1.78 | 2.16 | 2.21 | 2.34 | 1.82 | 2.06 |
| Hay, per ton | 13.85 | 18.75 | 28.57 | 25.56 | 17.69 | 20.88 |

In Table 15 a detailed statement is given of the distribution of receipts. There was a large number of sources of receipts, but the receipts from products other than fruit, wheat, and corn, were very small. Not all of the orchard farms had as great a diversification of income as is indicated by the average figures in this table.

TABLE 15.—*Distribution of receipts per farm on 48 orchard farms; average for 1916–1920*

| Sources of receipts | 1916 | 1917 | 1918 | 1919 | 1920 | Average 1916–1920 | Percentage of total |
|---|---|---|---|---|---|---|---|
| Crops: | *Dolls.* | *Dolls.* | *Dolls.* | *Dolls.* | *Dolls.* | *Dolls.* | *Per cent* |
| Apples | 9,216 | 5,356 | 11,115 | 9,298 | 12,335 | 9,464 | 93 |
| Wheat | 255 | 220 | 261 | 246 | 153 | 227 | 2 |
| Corn | 106 | 163 | 78 | 45 | 19 | 82 | 1 |
| Oats | 2 | 4 | 1 | 4 | | [1] 2 | [2] |
| Barley | 4 | | | | | [1] 1 | [2] |
| Hay | 18 | 15 | 20 | 23 | 46 | 24 | [2] |
| Rye | 3 | 6 | 9 | 1 | | 4 | [2] |
| Other crops | 12 | 13 | 20 | 10 | 8 | 13 | [2] |
| Total | 9,616 | 5,777 | 11,504 | 9,627 | 12,561 | 9,817 | 96 |
| Livestock: | | | | | | | |
| Dairy products | 12 | 16 | 24 | 24 | 24 | 20 | [2] |
| Cattle | 77 | 91 | 89 | 87 | 14 | 72 | 1 |
| Horses and colts | 52 | 43 | | 46 | | [3] 28 | [2] |
| Sheep and wool | 25 | 40 | 37 | 25 | 1 | 26 | [2] |
| Hogs | 60 | 125 | 177 | 76 | 35 | 95 | 1 |
| Poultry and eggs | 67 | 78 | 88 | 81 | 65 | 76 | 1 |
| Bees | 2 | | 1 | | | | |
| Total | 295 | 393 | 416 | 339 | 139 | 317 | 3 |
| Increase in feed inventories | 38 | 225 | | 9 | | [3] 54 | 1 |
| Miscellaneous receipts [4] | 31 | 34 | 39 | 24 | 17 | 29 | [2] |
| Total farm receipts | 9,980 | 6,429 | 11,959 | 9,999 | 12,717 | 10,217 | 100 |

[1] Receipts were not given for all years.
[2] Less than half of 1 per cent.
[3] 1918 and 1920 did not have receipts.
[4] Other receipts include cash rent, income from lumber, wood, etc.

### FAMILY LIVING FROM THE FARM

The orchard farmer in nearly every instance received, in addition to the returns in cash for his labor and for his investment, substantial returns in the form of food, fuel, and housing. The value of this additional return amounted to an average of $444 per farm. (Table 16.) Of this $444, $159 was for the use of the house, $276 for food and $9 for fuel. There was little variation over the five years in the quantities or values of the different items furnished the family by the farm. The total value of these items varied from $416 in 1920 to $462 in 1916.

Use of the house was valued at $150 to the family in 1916, and $170 in 1920. The food furnished by the farm to the family was valued at $238 in 1920 and $302 in 1916 but there were more people on these farms in 1916 than in 1920. There was an equivalent of four adults to the farm and the value of the family living furnished by the farm was $111 per year for each adult equivalent.

TABLE 16.—*Distribution of family living from the farm, 48 farms; average for 1916–1920*

| Items furnished by the farm for family use | Quantity | Value | Percentage of value of food items |
|---|---|---|---|
| | | *Dolls.* | *Per cent* |
| Corn—bushels | 1 | 1 | 0.4 |
| Wheat—do | 5 | 10 | 3.6 |
| Potatoes—do | 9 | 13 | 4.7 |
| Fruit and garden | | 52 | 18.9 |
| Miscellaneous | | 2 | .7 |
| Butter—pounds | 65 | 29 | 10.5 |
| Milk—gallons | 128 | 31 | 11.2 |
| Beef—pounds | 3 | 1 | .4 |
| Eggs—dozen | 56 | 18 | 6.5 |
| Poultry—head | 22 | 18 | 6.5 |
| Pork—pounds | 583 | 100 | 36.2 |
| Honey—do | 4 | 1 | .4 |
| Total food | | 276 | 100.0 |
| Wood—cords | 5 | 9 | |
| Use of house | | 159 | |
| Value of all items | | 444 | |
| Value per adult equivalent | | 111 | |

| | |
|---|---|
| Number of persons per farm, over 16 years of age | 3.0 |
| Number of persons per farm, under 16 years of age | 1.5 |
| Adult equivalent per farm | 4.0 |

## INCOMES FROM ORCHARD FARMING

The average returns from the 48 orchard farms for the five-year period of the study were as follows: Farm income, $4,232; labor income, $2,443; return on farm valuation, 9.4 per cent [2] (Table 17). The average farm income varied over the five-year period, 1916–1920, from $2,564 in 1920 to $5,660 in 1918. The labor income varied over this same period from $248 in 1920 to $4,124 in 1918. The per cent returned on farm valuation for the years 1916–1920 varied from 3.4 in 1920 to 15.6 in 1918.

A severe freeze in 1921 destroyed much of the apple crop and the total receipts were less than the expenses. In that year there was a minus farm income of $1,018 per farm; that is, the farm expenses were $1,018 greater than the farm receipts. It must be remembered that not only variations in yields but variations in prices are bound to have a decided effect on variations in income for any year or period of time. Prices received by the growers during the years of this study are given in Table 14.

In addition to these returns the orchard farmer and his family received from the farm, food, fuel, and house rent equivalent in value to $444, annually.

[2] See p. 6 for definitions of terms.

TABLE 17.—*Summary of the farm business on 48 orchard farms, 1916–1921* [1]

| Item | 1916 | 1917 | 1918 | 1919 | 1920 | Average 1916–1920 | 1921 | Average 1916–1921 |
|---|---|---|---|---|---|---|---|---|
| | *Dollars* | *Dollars* | *Dollars* | *Dollars* | *Dollars* | *Dollars* | *Dollars* | *Dollars* |
| Receipts | 9,980 | 6,429 | 11,959 | 9,999 | 12,717 | 10,217 | 2,017 | 8,850 |
| Expenses | 4,536 | 3,430 | 6,299 | 5,506 | 10,153 | 5,985 | 3,035 | 5,493 |
| Farm income | 5,444 | 2,999 | 5,660 | 4,493 | 2,564 | 4,232 | −1,018 | 3,357 |
| Interest on valuation at 5 per cent | 1,525 | 1,537 | 1,536 | 2,033 | 2,315 | 1,789 | 2,163 | 1,852 |
| Labor income | 3,919 | 1,462 | 4,124 | 2,460 | 249 | 2,443 | −3,181 | 1,506 |
| Per cent return on valuation | 15.4 | 7.3 | 15.6 | 8.8 | 3.4 | 9.4 | −4.4 | 6.8 |
| Value of farmer's labor | 743 | 753 | 871 | 922 | 967 | 851 | 871 | 854 |
| Value of family living from farm | 462 | 455 | 452 | 438 | 416 | 436 | | |
| Valuation of farm [2] | 30,505 | 30,735 | 30,732 | 40,662 | 46,306 | 35,788 | 43,253 | 37,032 |

[1] Minus sign (−) before any figures indicates a loss.
[2] Includes real estate, livestock, equipment, supplies, and operating cash.

## RELATION OF PRODUCTION TO RETURNS

Since, on the average, 93 per cent of the receipts on these orchard farms was from apples, the total returns varied from farm to farm largely as the production of apples varied.

The production per farm (Tables 18 and 19) was dependent upon the number of acres in bearing orchard and the yield per acre.

As the production per orchard increased, as shown in Table 18, the returns to capital and labor increased. The large orchards, taken as a class, made the larger net incomes, but some small orchards were handled particularly well and as a result had relatively good returns. The larger incomes on the larger orchard farms were mainly because of the larger size of business during a period of profitable apple production, but many of the small orchards in the Frederick County area had relatively low yields per acre, and as a result the incomes were relatively low (Table 19).

The following is an outstanding example of the effect of yield of apples on the income from the orchard: A 16-acre orchard, among the 48, had a five-year average yield of 102 barrels of good apples per acre and an average farm income of $3,750. This farm income was less than $500 below the average of the 48 farms on which the acreage of bearing apples was three and one-fourth times the acreage of the 16-acre orchard.

TABLE 18.—*Total apple production of orchards and relative incomes, 48 orchard farms; average for 1916 to 1920*

| Production groups | Orchards in each group | Average production for each group | Yield per acre | Distribution of farms by acres in bearing orchards | | | | | Farm income | Labor income | Return on valuation [1] | Capital valuation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 25 acres or less | 26 to 50 acres | 51 to 75 acres | 76 to 100 acres | 101 acres or more | | | | |
| | *No.* | *Bbls.* | *Bbls.* | *No.* | *No.* | *No.* | *No.* | *No.* | *Dolls.* | *Dolls.* | *P. ct.* | *Dolls.* |
| Below 1,000 barrels | 14 | 697 | 28 | 9 | 5 | | | | 1,187 | 292 | 3.2 | 17,875 |
| 1,000 to 2,000 barrels | 17 | 1,568 | 40 | 3 | 10 | 4 | | | 2,630 | 1,168 | 6.6 | 29,249 |
| 2,000 to 3,000 barrels | 5 | 2,256 | 48 | | 3 | 2 | | | 3,216 | 1,778 | 8.7 | 28,756 |
| 3,000 to 4,000 barrels | 5 | 3,551 | 45 | | | 1 | 4 | | 6,177 | 3,402 | 9.0 | 55,491 |
| 4,000 barrels and over | 7 | 6,496 | 53 | | | | 3 | 4 | 13,549 | 9,627 | 15.3 | 78,442 |
| All orchards | 48 | 2,311 | 44 | 12 | 18 | 7 | 7 | 4 | 4,232 | 2,443 | 9.4 | 35,788 |

[1] Per cent returned on valuation is obtained by deducting what the operator considers worth his time from the "farm income" and dividing this balance by the value of the farm, including real estate, equipment, and supplies.

TABLE 19.—*Summary of production and returns on 48 orchard farms of different sizes and different yields of apples; average for 1916–1920*

| Item | 50 acres or less of bearing orchard | | Over 50 acres of bearing orchard | |
|---|---|---|---|---|
| | Yields per acre of | | Yields per acre of | |
| | 40 barrels or less | Over 40 barrels | 40 barrels or less | Over 40 barrels |
| Production of apples per farm—barrels | 1,214 | 2,129 | 4,036 | 7,535 |
| Yield of apples per acre—do | 41 | 76 | 49 | 77 |
| Barreled—do | 31 | 57 | 35 | 53 |
| Culls—do | 10 | 19 | 14 | 24 |
| Receipts per farm—dollars | * 4,132 | 6,855 | 12,934 | 23,235 |
| Farm income per farm—do | 1,440 | 2,743 | 5,211 | 10,132 |
| Labor income per farm—do | 325 | 1,550 | 3,087 | 6,688 |
| Return on capital—per cent | 3.7 | 8.5 | 9.8 | 12.8 |
| Value of operator's labor—dollars | 616 | 708 | 1,028 | 1,295 |

## ORCHARD OPERATION AND PRODUCTION

The operators of the better yielding orchards had more equipment, more money with which to operate, used more labor, and spent more money in the care of their orchards than did the operators of the poorer yielding orchards. (See Table 20.)

TABLE 20.—*Organization of 48 orchard farms of different sizes and of different producing capacities; average for 1916–1920*

| Organization factors | 50 acres and less of bearing orchard | | Over 50 acres of bearing orchard | |
|---|---|---|---|---|
| | Yields per acre | | Yields per acre | |
| | 40 barrels or less | Over 40 barrels | 40 barrels or less | Over 40 barrels |
| Farms—number | 17 | 13 | 8 | 10 |
| Size of farm—acres | 102 | 87 | 219 | 201 |
| Tillable land per farm—do | 86 | 72 | 190 | 175 |
| Crops outside of orchard—do | 16.1 | 23.2 | 49.1 | 38.5 |
| Fruits interplanted in orchard—do | 5.3 | .9 | | |
| Total orchard per farm—do | 55 | 42 | 100 | 115 |
| Bearing orchard per farm—do | 30 | 28 | 82 | 96 |
| 10 to 14 years of age—do | 12 | 8 | 20 | 21 |
| 15 to 19 years of age—do | 8 | 12 | 30 | 41 |
| 20 to 24 years of age—do | 6 | 3 | 20 | 18 |
| 25 to 29 years of age—do | 1 | 3 | 7 | 6 |
| Over 30 years of age—do | 3 | 2 | 5 | 10 |
| Nonbearing (under 10 years)—do | 25 | 14 | 18 | 19 |
| Total labor per farm—months | 34.9 | 40.7 | 71.6 | 106.2 |
| Picking and packing labor (hired)—do | 6.4 | 10.8 | 28.1 | 51.2 |
| Other hired labor—do | 15.0 | 15.0 | 30.9 | 41.8 |
| Operator's labor—do | 12.0 | 12.0 | 12.0 | 12.0 |
| Family labor—do | 1.5 | 2.9 | .6 | 1.2 |
| Work stock per farm—number | 2.9 | 3.1 | 6.3 | 6.8 |
| Farms having tractors in 1920—do | 4 | 2 | 2 | 7 |
| Farms having auto trucks in 1920—do | | 3 | 5 | 4 |
| Expenses: | | | | |
| Preharvest—dollars | 1,518 | 2,137 | 3,545 | 5,567 |
| Harvest—do | 1,174 | 1,975 | 4,178 | 7,536 |
| Valuation of farm—do | 22,304 | 23,852 | 42,479 | 68,874 |
| Real estate—do | 20,537 | 21,754 | 37,175 | 62,414 |
| Other capital—do | 1,767 | 2,098 | 5,304 | 6,460 |
| Machinery—do | 319 | 501 | 745 | 1,431 |
| Workstock—do | 299 | 354 | 851 | 907 |
| Other livestock—do | 437 | 383 | 1,103 | 887 |
| Cash and supplies—do | 712 | 860 | 2,605 | 3,235 |

On the better yielding orchards of 50 acres or less of bearing trees an average of 10.9 days of preharvest labor was used per tillable acre, whereas on the lower yielding orchards in the same size group only 7.2 days of labor per tillable acre was used before harvest. The better yielding farms, therefore, used about 55 per cent more preharvest labor per tillable acre than did the poorer yielding farms.

Of the larger orchards (over 50 acres of bearing trees) those having a yield in excess of 40 barrels per acre used an average of 8.3 days of labor per tillable acre before harvest. Those with yields of less than 40 barrels per acre used 5.5 days, or an average of 2.8 days per tillable acre less than the higher yielding group. There was a decided difference in the value of the equipment on these farms, the better yielding orchards in each size group having nearly double the value of machinery of the poorer yielding orchards. As previously shown (Table 19), the larger and higher yielding orchards returned the higher incomes.

A part of the higher incomes of the better yielding orchards in each size group may be due to age of trees, varieties of apples, location of orchards, and a number of other causes, but it seems evident that much of the success of the better orchards may be attributed to the better care of the soil and trees. The better yielding orchards received a greater amount of labor and materials in spraying, fertilizing, and pruning than did the less productive orchards. These greater expenditures apparently resulted in increased yields of fruit that paid well during the years of the survey.

Examples of differences in orchard management were found in the practices attending the utilization of interplanted crops. Where crops were interplanted in the orchard and removed the yield of apples was markedly lower than the yields of orchards where the interplanted crops were left on the land. There was an average of 22 acres of interplanted crops in the 48 orchards; 64 per cent of the area of interplanted crops was harvested and the crops removed while the crops on the remaining 36 per cent of the interplanted were left on the soil. Where interplanting was practiced it was seldom that such practice applied to the whole orchard in any year. A rotation in which sod usually followed the interplanted crop for a period of two years was a common practice. In some instances interplanting was practiced only for the purpose of renewing the sod.

TABLE 21.—*Interplanted cropping practices and relative yields of apples, 48 orchard farms; average for 1916–1920*

| Size of orchard | Yield of packed apples per acre | Orchard farms | Interplanted crops in orchards | | | | | Average yield per acre packed apples |
|---|---|---|---|---|---|---|---|---|
| | | | Total | Crops removed | | Crops left on land | | |
| | *Barrels* | *Number* | *Acres* | *Acres* | *Per cent* | *Acres* | *Per cent* | *Barrels* |
| 50 acres or less of bearing trees. | 40 or less | 17 | 19 | 15 | 79 | 4 | 21 | 31 |
| | Over 40 | 13 | 14 | 8 | 57 | 6 | 43 | 57 |
| Over 50 acres of bearing trees. | 40 and less | 7 | 22 | 19 | 86 | 3 | 14 | 35 |
| | Over 40 | 11 | 39 | 17 | 44 | 22 | 56 | 53 |
| All farms: 52 acres of bearing trees. | 44 | 48 | 22 | 14 | 64 | 8 | 36 | 44 |

Among those orchards of 50 acres or less 17 orchards in the yield group of 40 barrels or less had an average yield of 31 barrels. These 17 orchards had 19 acres of interplanted crops, of which 80 per cent was removed and 20 per cent left on the land. The other 14 orchards in this size group, but yielding over 40 barrels per acre, had an average yield of 57 barrels per acre. These 13 high-yielding orchards had an average of 14 acres of interplanted crops in the orchard, only 58 per cent of which was removed. (See Table 22.)

Among the large orchards those having a yield per acre of less than 40 barrels showed that 86 per cent of the interplanted crops had been removed, whereas those with a yield in excess of 40 barrels per acre showed that 44 per cent of the interplanted crops had been removed.

FIG. 3.—Corn interplanted in the orchard. This practice lowers the yield of apples

Corn and hay were the principal crops planted in orchards for removal, although wheat was sometimes interplanted for the same purpose. The extent of intercropping with corn is shown by the fact that only 3 of the 48 orchards were not interplanted with this crop in some part of the orchard area during the five years (figs. 3 and 4).

Sod culture, where the grass is left uncut for many years, is another rather common method of soil management in the Shenandoah Valley. A few of the 48 orchards employed this method of soil management with excellent results. In fact, the orchard with the largest yield per acre was under this system of soil management. A better yield was obtained where the plant growth was used as a mulch than where it was removed. Some of the orchards are on rough land where sod culture is the only feasible method of soil management (fig. 5).

The orchards which had the best yields usually were those in which such cover crops as alfalfa, cowpeas, soy beans, clover, or a

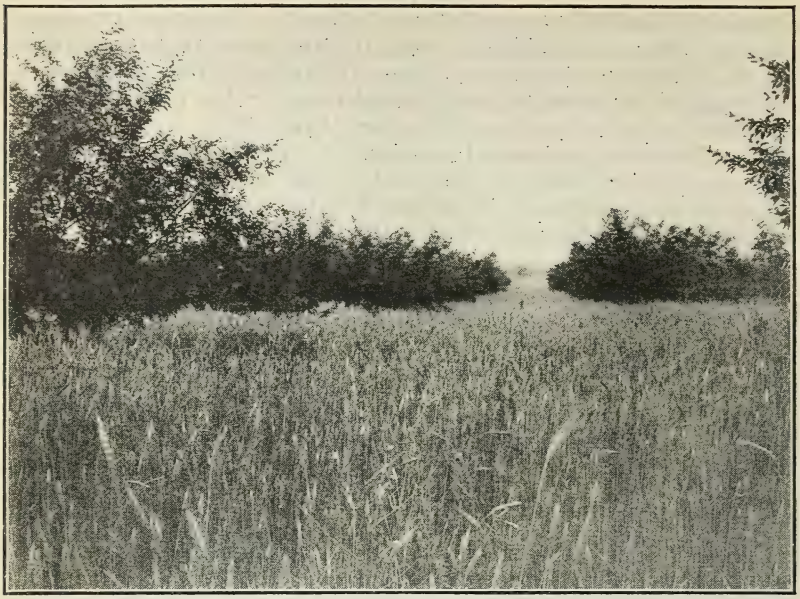

FIG. 4.—Wheat in a young apple orchard near Winchester, Va. Wheat grown in the orchard is often cut with the cradle. This handwork adds much to the cost of production. Apple trees do not bear well when competing with interplanted crops

FIG. 5.—Cultivation is difficult where the surface is so thickly covered with limestone fragments. The rugged topography is a rather general characteristic of the Shenandoah Valley

green manure crop like rye were used as soil builders. Often these soiling crops were used in a rotation with other crops like hay and corn. This method, though superior to the system that removed all

crops, was not so productive of good yields as the system which provided for cover crops alone. Some of the best orchards used alfalfa, soy beans, and clover as the predominant orchard crops. The results obtained through such practice would indicate that a much wider use of these crops by growers in the valley would be warranted. Alfalfa seems to be a favored crop, and it recommends itself because of its fertilizing value and because it produces several crops in a season. If one crop is taken for hay the following crops can be left on the soil (fig. 6).

## COST OF PRODUCING APPLES

The production of graded apples is the final aim of these orchard farmers. Apples were the source of 93 per cent of the total receipts. The remainder of the receipts were more or less incidental to the

FIG. 6.—One of the best orchards on Apple Pie Ridge. The interplanted crops were not removed from this orchard and it returned a good income

production of apples—that is, usually they were from surpluses of food and feed products sold. Therefore, all farm expenses, of whatever nature, were charged to the barreled-apple account, and any receipts other than those for barreled apples were credited to the apple account. In arriving at the cost of producing a barrel of apples the total farm expense after reductions were made for miscellanous receipts was divided by the total number of barrels of apples.

In the analysis of the cost of producing apples the items of cost are shown in one classification as cash and noncash costs and in another classification as fixed and variable costs. Under these general classifications the cost items were reclassified for the purpose of showing the effect of yield and of size of orchard on the cost per unit. In the cash and noncash classification of costs are shown those expenses for labor, materials, upkeep, and overhead.

### CASH AND NONCASH COSTS

Farm products vary greatly in the demands they make upon the farmer while they are in the course of production. Some of them demand relatively large amounts of labor, but distributed throughout the year so that it can be performed by the operator and members of his family, with little need for cash expenditures for wage labor. Some farm products make little demand for materials and supplies other than those raised on the farm. In the production of apples there is considerable demand upon the operator for direct cash expenditures for both hired labor and materials.

Upon the 48 orchard farms cash costs averaged for the five-year period, 1916–1920, 63 per cent of the total cost of production and amounted to $5,170 per orchard. (See Table 22.) This amount was the total outlay for 12 major items, the most important of which had to do with the harvesting of the apples. The four items of expense required in harvesting—that is, picking, packing, barrels, and hauling—required a cash expenditure per orchard of $3,223, or 62 per cent of all cash costs.

TABLE 22.—*Summary of production costs per farm, 48 orchard farms; average for 1916–1920*

| Item | 1916 | 1917 | 1918 | 1919 | 1920 | Average 1916–1920 |
|---|---|---|---|---|---|---|
| Cash costs: | *Dolls.* | *Dolls.* | *Dolls.* | *Dolls.* | *Dolls.* | *Dolls.* |
| Regular hired labor | 720 | 875 | 987 | 1,018 | 1,159 | 952 |
| Picking and packing | 1,164 | 732 | 1,715 | 1,462 | 2,446 | 1,504 |
| Barrels | 1,256 | 485 | 1,728 | 850 | 3,471 | 1,558 |
| Fertilizer | 73 | 53 | 78 | 165 | 255 | 125 |
| Spray material | 127 | 109 | 155 | 189 | 237 | 163 |
| Purchased grain, horseshoeing, and veterinary | 132 | 180 | 226 | 302 | 260 | 220 |
| Repairs: | | | | | | |
| Buildings and fences | 38 | 50 | 96 | 73 | 15 | 54 |
| Machinery | 54 | 57 | 76 | 130 | 116 | 87 |
| Tree resets | 16 | 17 | 16 | 17 | 17 | 16 |
| Hauling apples (part hired) | 137 | 63 | 226 | 113 | 265 | 161 |
| Taxes and insurance | 104 | 105 | 114 | 126 | 190 | 128 |
| Miscellaneous | 104 | 123 | 186 | 302 | 296 | 202 |
| Total cash costs | 3,925 | 2,849 | 5,603 | 4,747 | 8,727 | 5,170 |
| Noncash costs: | | | | | | |
| Reserves for depreciation— | | | | | | |
| Buildings and fences | 96 | 105 | 113 | 120 | 149 | 117 |
| Machinery | 117 | 134 | 193 | 273 | 329 | 209 |
| Deductions from profits— | | | | | | |
| Operator's labor | 747 | 751 | 868 | 921 | 967 | 851 |
| Family labor | 102 | 79 | 50 | 52 | 64 | 69 |
| Interest on farm valuation at 5 per cent | 1,524 | 1,535 | 1,534 | 2,032 | 2,318 | 1,789 |
| Total noncash costs | 2,586 | 2,604 | 2,758 | 3,398 | 3,827 | 3,035 |
| Total cash and noncash costs (gross cost) | 6,511 | 5,453 | 8,361 | 8,145 | 12,554 | 8,205 |
| Credit deductions: | | | | | | |
| Sale of bulk apples | 574 | 993 | 745 | 2,109 | 871 | 1,058 |
| Miscellaneous farm receipts | 817 | 1,177 | 611 | 705 | 373 | 737 |
| Total deductions | 1,391 | 2,170 | 1,356 | 2,814 | 1,244 | 1,795 |
| Gross cost less deductions (net costs) | 5,120 | 3,283 | 7,005 | 5,331 | 11,310 | 6,410 |
| Net cost per acre | 114 | 67 | 140 | 95 | 188 | 121 |
| Net cost per barrel | 1.53 | 2.48 | 2.88 | 3.78 | 3.70 | 2.87 |

For the five years, 1916–1920, the average cost of barrels was $0.67 each. The average yearly price over this period varied from $0.37 to $1.13 each. During periods of such wide variations in prices it is difficult for the grower to know just what attitude to

take with respect to purchasing barrels. In anticipation of a normal crop some growers in the fall of 1920 laid in a supply of barrels for the next season's crop. The crop the following year was practically wiped out by late spring freezes, making it necessary to hold the barrels in storage until the next season.

The annual preharvest cash costs for the five years were $1,927 per orchard, or approximately $35 per acre. Of this amount slightly less than one-half, or $952, was paid for regular hired labor. These preharvest cash costs amounted to an average of $152 per month for the entire year, but the outlay was heavy during some months and light during others. Inasmuch as there was little or no income excepting from the apple crop it was necessary to carry considerable cash in a checking account at the bank or borrow the money as needed.

The annual cost of commercial fertilizer was $125 per farm, or 5 cents per barrel of barreled apples. The spray material used cost $163 per farm, or 7 cents per barrel of apples. Grain purchased for feed, horseshoeing, and veterinary services for horses cost $220 per farm, or 10 cents per barrel of barreled apples.

The cash outlay for repairs on machinery, buildings, and fences amounted to $141 per farm, or 6 cents per barrel of barreled apples. Tree resets, considered as an upkeep for the orchard, was $16 per farm, or 1 cent per barrel. The cost of taxes and insurance was $128 per farm, or 6 cents per barrel of barreled apples. Miscellaneous costs, such as automobile for farm use, gasoline and oil, freight, telephone and telegraph service, road toll, and unclassified items, amounted to $182 per farm, or 8 cents per barrel of barreled apples. The cash charge against hauling apples of $161 per farm, or 7 cents per barrel of apples was an outlay for contract work in those instances where the growers lacked equipment necessary to move apples from the orchard to storage or siding. Many growers hauled their own apples with teams, using wagons with specially constructed racks. Several growers now own motor trucks.

The noncash costs are designated as "depreciation for reserves" and "deductions from profits." The amount charged annually as depreciation is not a direct cash expense for the particular year, but it must be met at some future time by the purchase of new machines and new buildings. The annual reserve allowed for depreciation of buildings and fences was $117 per orchard farm, or 5 cents per barrel of apples, and reserves for depreciation of machinery amounted to $209 per farm, or 9 cents per barrel. Those costs that are here termed deductions from profits consist of interest upon the valuation of farm, equipment and supplies, and the wage value of the work done by the farmer and unpaid members of his family. The deductions from profits on the average were: For interest on capital, $1,789 per farm, or 77 cents per barrel; for operator's labor, $851 per farm, or 37 cents per barrel, and for family labor $69 per farm, or 3 cents per barrel.

Variations in costs from year to year (1916 to 1920), as well as for the average of the five years, are given in Table 23.

#### VARIATION IN APPLE-PRODUCTION COSTS

Operating expenses of the orchards in this study showed great variation during the period 1916–1920. (Fig. 7.) Causes of variations in operating costs are partly under the control of the operator,

but part of them are influences over which he has little or no control. The causes beyond the control of the individual grower are changes in the price level of the different cost factors and changes in yields and costs owing to climatic conditions. Cost variations coming under the control of the operator are those influenced by different methods of orchard management. Among the 48 orchards the wide variations in costs may be at least partly ascribed to different methods of soil and tree management.

Prices of the various items going into the production of apples increased steadily during the period of this study until some had more than trebled by 1920. The increase in prices is illustrated in the changes in preharvest farm costs, which varied from $3,954 in 1916 to $6,372 in 1920, and again in the harvesting costs, which were $2,557 for a 3,331-barrel crop in 1916 and $6,182 for a 3,507-barrel crop in 1920. (Fig. 7.)

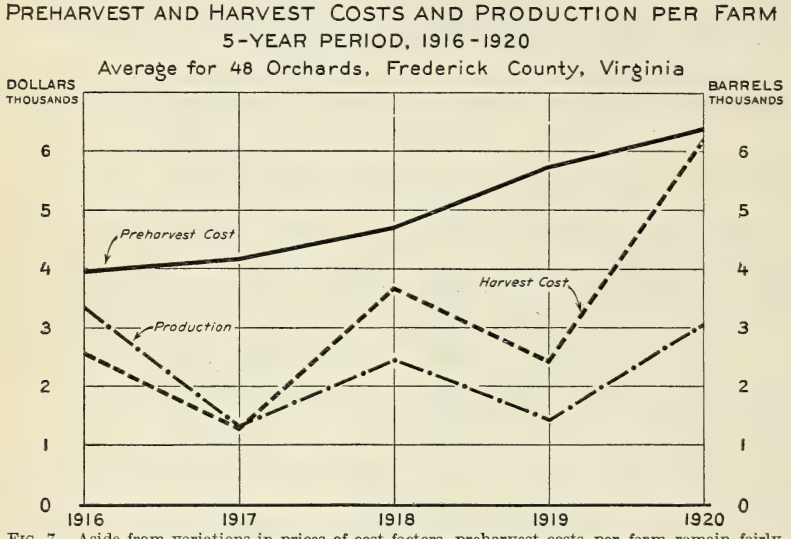


FIG. 7.—Aside from variations in prices of cost factors, preharvest costs per farm remain fairly constant from year to year. Harvesting costs, however, vary rather directly in proportion to variations in yields

Total costs per farm increased for the five-year period, but for the different years the cost per farm varied a great deal because of differences in annual yield and of harvesting costs. Harvesting costs in normal times are about the same in amount as preharvest costs, but in years of low yields or high yields the corresponding changes in the total harvesting costs cause considerable difference in the total farm expenditures for production. Thus with a 1,340-barrel yield in 1917 the net cost per farm was $3,283, whereas with a 3,331-barrel yield in 1916 the net cost per farm was $5,120, notwithstanding the fact that the prices of the cost factors in 1917 had increased over those of 1916.

### COST VARIATIONS CAUSED BY DIFFERENCES IN ORCHARD MANAGEMENT

In Figure 8 variations in costs per barrel are shown. The five-year average costs for these farms ranged from $1.64 to $5.66 per barrel.

Much of the variation in the cost of production among the several orchards is due to different degrees of efficiency in management. A measure of the efficiency of management may be found in the relationship of cost per barrel and quantity of production on the individual farm to the average cost per barrel and the average quantity of production on all farms. In nearly all instances where the costs per barrel were below the average ($2.87) and the quantity of production was above the average (44 barrels of packed apples per acre) the growers made good returns on their investments in addition

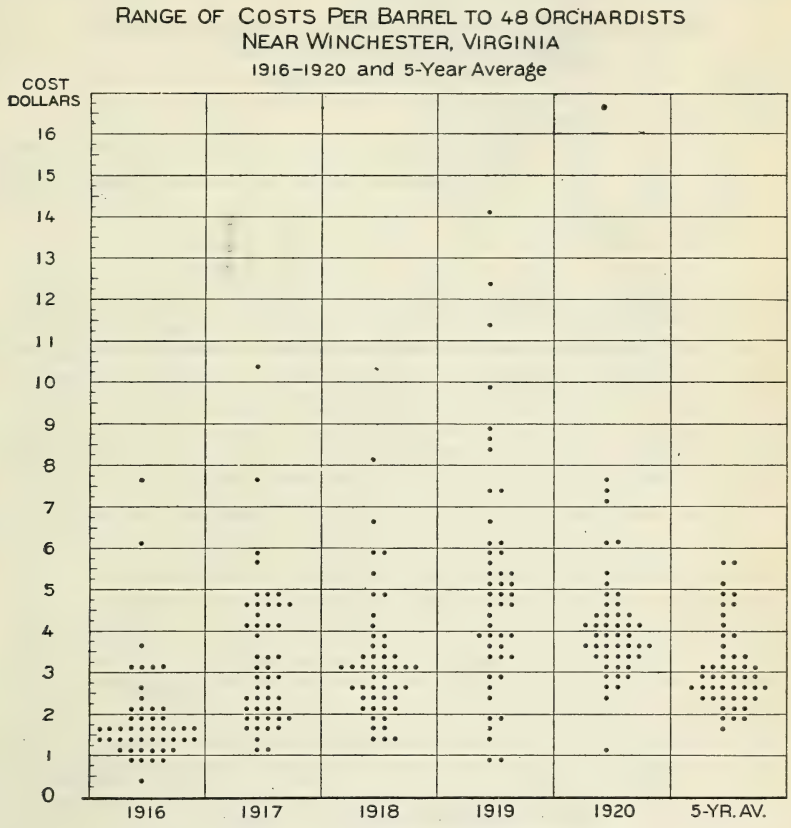


FIG. 8.—During the five years of the study the cost of producing a barrel of apples varied on individual farms from less than $1 to more than $15 per barrel

to receiving good wages for their management and labor. A few growers who produced at costs ranging somewhat above the average cost of $2.87 still made good returns because, although their profit per barrel of fruit was less than the average, they had large orchards and their total profits were satisfactory.

Production costs on some of the orchard farms varied widely from the average cost because of lack of good balance in the factors of production. The factors of production were out of balance in that there was too much orchard for the available labor and equipment. In some instances the cost was much lower than the average, as was the yield per acre, the low costs being possible under such conditions

because of lack of attention to the proper amount of labor and equipment necessary to take good care of the orchard. Although the cost per barrel was low, the total profits were low because of low production. Under such conditions it is likely that over a long period of time lack of proper attention to the orchard would result in a decreased valuation of the orchard and finally in high costs per barrel of product. In most cases, however, an improper balance in the factors of production results in a higher-than-average cost rather than lower-than-average cost.

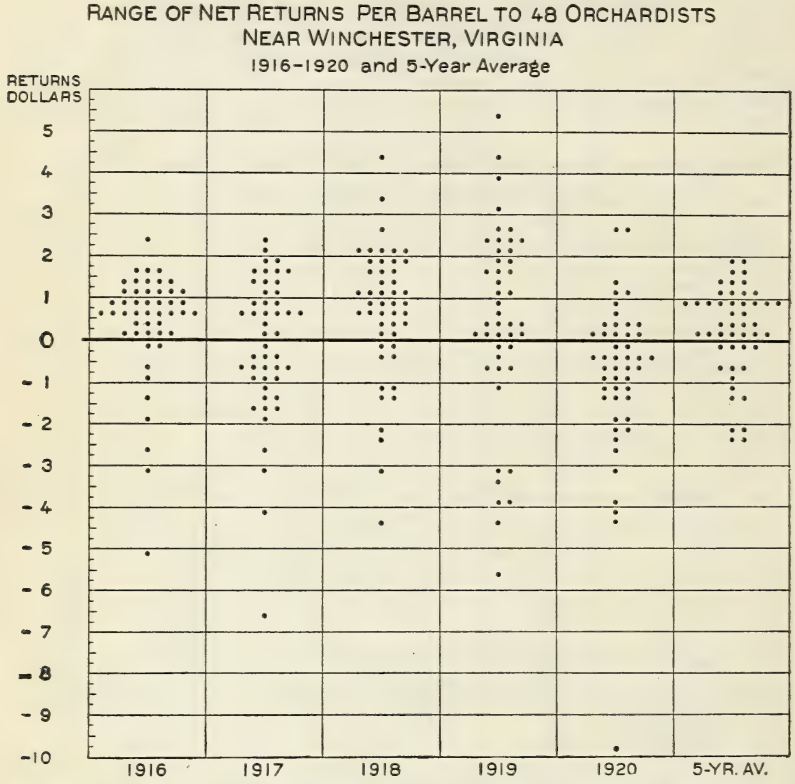


FIG. 9.—During the five years of the study net returns varied on individual farms from a loss of about $7 to a profit of more than $5 per barrel

The relation of costs to net returns per barrel are shown in Table 23. In 1920 the average grower failed by 19 cents to reach the cost-of-production line, whereas in 1918 the net returns per barrel were $1.32 above the cost of production. The average net selling price for the five years was $3.65 per barrel. In Figure 9 is shown the variation in net returns per barrel of apples by years. The five-year average net returns per barrel varied on these different farms from −$2.37 to $1.83. Fifteen orchard farms failed to receive cost of production and 11 orchard farms showed a return above costs of more than $1 per barrel.

Some of the orchardists drew so heavily upon their cash resources to develop new orchards that they were forced to neglect temporarily

their bearing orchards, and as a result profits were low during the period of the survey. Since orcharding is a rather new enterprise on some of these farms, the growers have had little means of knowing from personal experience just how much cash and equipment were needed per acre to handle an orchard. Their idea of how many acres they could plant and take good care of has not always been correct, with the result that some have more orchard than they can take good care of with present facilities.

TABLE 23.—*Net cost, selling price, and net return per barrel of apples; average for 1916–1920*

| Item | 1916 | 1917 | 1918 | 1919 | 1920 | Average, 1916–1920 |
|---|---|---|---|---|---|---|
| | *Dolls.* | *Dolls.* | *Dolls.* | *Dolls.* | *Dolls.* | *Dolls.* |
| Net cost per barrel | 1.53 | 2.48 | 2.88 | 3.78 | 3.70 | 2.87 |
| Selling price per barrel | 2.58 | 3.31 | 4.26 | 5.10 | 3.75 | 3.80 |
| Storage price per barrel | .06 | .15 | .06 | .22 | .24 | .15 |
| Net selling price per barrel | 2.52 | 3.16 | 4.20 | 4.88 | 3.51 | 3.65 |
| Difference | .99 | .68 | 1.32 | 1.10 | [1] −.19 | .78 |

[1] Cost per barrel above selling price.

The increased expenditures per acre in the case of the higher yielding orchards was good economy, measured in returns per acre. On the smaller orchards (50 acres or less) of higher yields, production costs were $54.35 per acre greater than on the lower yielding orchards but the yield was 57 barrels of graded apples on the better yielding orchards as compared to 31 barrels on the lower yielding orchards. This increase in yield resulted in lower production costs per barrel of graded fruit, the difference being 77 cents per barrel in favor of the higher yielding orchards. The same tendencies, although less striking, were noted on the larger orchards.

### SIZE OF ORCHARD, YIELD PER ACRE, AND COST OF PRODUCTION

As a general rule an increase in either or both of the size of orchard and yield per acre resulted in a decreased cost per barrel during this period. (See Table 24.) The 11 orchards of over 50 acres of bearing trees that produced more than 40 barrels of packed apples per acre had an average cost of $2.54 per barrel over the years 1916 through 1920. The small orchards, on the other hand, that had less than 50 acres in bearing trees and produced 40 barrels or less per acre had an average cost per barrel of $3.58 during the same years. Yield probably had a greater influence than any other single factor on the cost of a barrel of apples, but size of orchard appeared to have some influence.

The principal advantage of the larger orchards and the higher yielding orchards over the smaller and lower producing orchards was found in the lower overhead and fixed-production costs per barrel. Depreciation in buildings and equipment continues in much the same proportions, whether they are used to their full capacities or are only partially utilized. Maintenance of work horses is almost the same, whether these horses are used rather steadily throughout the year or are allowed to stand idle part of the season for lack of productive work. Apparently the orchards of large size and orchards of high yield benefited by a better distribution of labor and a greater volume of production over which to distribute their overhead and fixed charges.

TABLE 24.—*Size of orchard, yield per acre, and cost of production on 48 orchard farms; average for 1916–1920*

| Size | Yield (per acre) | Orchards | Size of orchard | Yield per acre [1] | Net cost | |
|---|---|---|---|---|---|---|
| | | | | | Per acre | Per barrel |
| *Acres* | *Barrels* | *Number* | *Acres* | *Barrels* | *Dollars* | *Dollars* |
| 50 or less of bearing trees | 40 or less | 17 | 30 | 31 | 109.00 | 3.58 |
| | Over 40 | 13 | 28 | 57 | 163.35 | 2.81 |
| Over 50 of bearing trees | 40 or less | 7 | 82 | 35 | 94.66 | 2.72 |
| | Over 40 | 11 | 96 | 53 | 135.80 | 2.54 |

[1] Includes barreled apples only. Culls were considered a by-product and their value deducted from the total cost of operating the farms.

### RELATION OF VOLUME OF PRODUCTION TO FIXED AND VARIABLE COSTS

In the operation of an orchard farm there are certain expenses which are variable and certain others which are fixed in amount in any particular year. Variable costs are hired labor, fertilizer, spraying, and harvesting expenses. Certain other annual expenses, common to every orchard, are more or less fixed in amount. They may be defined as costs necessary to keep the business going regardless of the quantity of production. Included in fixed costs are interest, operator's labor, cost of keeping work stock, repair of fences, buildings, and machinery; depreciation of fences, buildings, and equipment; taxes, fire insurance, and other miscellaneous expenses.

Fixed costs depend somewhat upon the size of the orchard inasmuch as within certain limits the size of the business influences the quantity of equipment and improvements to be kept in condition. Such costs as taxes and insurance would also change with the size of the orchards. It is important that the grower carefully consider his fixed costs, for at least a part of these must be taken care of each year, whether production or prices are high or low. But the greater the volume of business the less significant is the fixed cost per unit of product. (See Table 25.)

On orchard farms most fixed charges are incurred irrespective of the volume of production, whereas variable costs for such operations as picking and packing apples and for barrels bear a definite relation to the volume of production. As a whole, variable costs per acre on these farms increased with volume of production, whereas variable costs per barrel were about the same for the orchards of different sizes and yields.

TABLE 25.—*Effect of size of orchard and yield of apples on fixed and variable costs on 48 orchard farms; average for 1916–1920*

| Size | Yield per acre | Fixed cost per acre | Variable costs per acre | | Fixed cost per barrel | Variable cost per barrel |
|---|---|---|---|---|---|---|
| | | | Pre-harvest | Harvest | | |
| *Acres* | *Barrels* | *Dollars* | *Dollars* | *Dollars* | *Dollars* | *Dollars* |
| 50 or less of bearing trees | 40 or less | 61.62 | 17.23 | 30.15 | 2.00 | 1.58 |
| | Over 40 | 79.77 | 28.94 | 54.64 | 1.35 | 1.46 |
| Over 50 of bearing trees | 40 or less | 40.56 | 17.08 | 37.02 | 1.17 | 1.55 |
| | Over 40 | 55.67 | 20.37 | 59.76 | 1.04 | 1.50 |

## ORGANIZATION OF THE UNITED STATES DEPARTMENT OF AGRICULTURE

January 3, 1927

| | |
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| *Director of Regulatory Work* | WALTER G. CAMPBELL. |
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